ENVIRONMENTAL PROTECTION

OFFICE OF LEGAL AFFAIRS

General Practice and Procedure

Proposed Readoption with Amendments: N.J.A.C. 7:1D

Proposed Repeal and New Rule: N.J.A.C. 7:1D, Appendix A

Authorized by:	Bradley M. Campbell, Commissioner Department of Environmental Protection
Authority:	N.J.S.A. 13B-3(d) and (e), 13B-5(a), 13:1D-1 et seq., and Executive Order No. 34 (1976)
Calendar Reference:	See Summary below for explanation of exception to calendar requirement
DEP Docket Number:	27-05-07/534
Proposal Number:	PRN-2005-

Submit written comments by (60 days from publication) to:

Alice A. Previte, Esq.

Attention: DEP Docket Number 27-05-07/534

Office of Legal Affairs

New Jersey Department of Environmental Protection

401 East State Street

PO Box 402

Trenton, NJ 08625-0402

The Department of Environmental Protection (Department) requests that commenters submit comments on disk or CD as well as on paper. Submittal of a disk or CD is not a requirement. The Department prefers Microsoft Word 6.0 or above. Macintosh™ formats should not be used. Each comment should be identified by the applicable N.J.A.C. citation, with the commenter's name and affiliation following the comment.

The agency proposal follows:

Summary

Since the Department has provided a 60-day comment period on this notice of proposal, this notice is excepted from the rulemaking calendar requirement pursuant to N.J.A.C. 1:30-3.3(a)5.

Pursuant to the requirements of Executive Order No. 66(1978), the Department's General Practice and Procedure rules, N.J.A.C. 7:1D, are scheduled to expire on July 31, 2005. The filing of this proposal with the Office of Administrative Law on or before that date automatically extended the expiration date 180 days, until January 27, 2006, in accordance with the Administrative Procedure Act. (See N.J.S.A. 52:14B-5.1(c).) As required by the Executive Order, the Department has reviewed these rules and has determined them to be necessary, reasonable and proper for the purpose for which they were originally promulgated. Therefore, the Department proposes to readopt this chapter with the amendments set forth below.

The existing rules at N.J.A.C. 7:1D-1 establish the procedure for the public to petition the Department for rulemaking. The rules are consistent with the Administrative Procedure Act concerning rule petitions. (See N.J.S.A. 58:14B-4(f).) N.J.A.C. 7:1D-2 governs the debarment, suspension, or disqualification of persons from contracting with the Department, including the procedure and scope of such action. The subchapter is consistent with Executive Order No. 34 (1976), which requires all persons contracting with the State to compete fairly and perform honestly in their dealings with the State. The Department proposes to readopt these subchapters without change.

N.J.A.C. 7:1D-5 establishes the circumstances under which the Department will extend the public comment period on a rule proposal, hold a public hearing on a rule proposal, and provide notice of rulemaking to the public. The Department proposes to readopt subchapter 5 without change.

Existing Appendix A to the chapter contains the Department's "Mapping and Digital Data Standards," which set forth the technical standards for the development of digital maps that are submitted to the Department. The Department proposes to repeal Appendix A and replace it with a new Appendix in order to bring the Department's standards into conformance with existing technological standards, which have advanced considerably since the adoption of the existing standards in 1996 (see 27 N.J.R. 2337(a), 27 N.J.R. 2858(a)).

In its previous readoption of N.J.A.C. 7:1D (see 32 N.J.R. 1892(a), 32 N.J.R. 3090(b)), the Department indicated that it was in the process of reviewing the "Geospatial Positioning Accuracy Standards" that the Federal Geographic Data Committee (FGDC) developed and endorsed in June 1998. The Geospatial Positioning Accuracy Standards were developed to provide consistency in reporting the accuracy of point geospatial data collected by different

activities, such as geodetic surveying, topographic mapping, bathymetric mapping, facilities management mapping, and cadastral surveying, and to provide a single method that defines how to report the positional accuracy for all point geospatial data collected, produced or disseminated by the Federal government and the nation.

As discussed in the Overview to proposed new Appendix A, the Mapping and Digital Data Standards remain founded on three cornerstones: accepted standards of accuracy; mapping of data using the state plane coordinate system; and full documentation of geographic data ("metadata").

The Overview to proposed new Appendix A does not contain the historic aspects of the evolution and background of GIS in the Department, which are in existing Appendix A. Because GIS has been in use at the Department for more than a decade, and is widely used in the regulated community, the lengthy explanation in the existing Appendix A is no longer necessary.

Section 2.0, Basemaps, of existing Appendix A appears at subsection 7.3 of proposed new Appendix A. Proposed new section 2.0, Geospatial Positioning Accuracy Standards and Testing, contains the accuracy standards for data submitted to the Department. The accuracy standards are the first cornerstone of the Department's mapping standards, as discussed in the Overview to proposed new Appendix A. All mapping must meet accepted accuracy standards. Testing against base maps or photographs whose accuracy is known will determine the accuracy of data, which will ensure accuracy of the geographic data and compatibility of digital information.

Proposed new section 2.0 incorporates portions of existing section 8.0, National Map Accuracy Standard (NMAS), at subsection 2.2. At proposed subsection 2.2, the Department has reproduced the portion of the NMAS to which the regulated community will need to refer most

frequently. The NMAS at existing section 8.0 is reproduced at proposed subsection 7.1, for reference.

The remainder of proposed section 2.0 is new, and includes a discussion at subsection 2.1 of the FGDC and the Geospatial Positioning Accuracy Standards Part 3: National Standards for Spatial Data Accuracy (1998), on which the proposed new standards are based. At subsection 2.3, the Department discusses threshold accuracy values. Threshold accuracy values are a means of ensuring the accuracy of data. The Department supports the accuracy tests of the NMAS, but prefers the accuracy tests and reporting language of the National Standard for Spatial Data Accuracy (NSSDA), as endorsed by the FGDC.

The second cornerstone on which the Department's Mapping and Digital Data Standards are based is the reference system for the data submitted to the Department. Maintaining a uniform reference system facilitates data sharing and provides the basic standards for creating, describing and distributing spatial data on the Department's GIS. As set forth in proposed new section 3.0, New Jersey Department of Environmental Protection GIS Data Standards, digital data provided to or produced for the Department are required to be in North American Datum 1983 (NAD83) horizontal geodetic datum and in the New Jersey State Plane Coordinate System (SPC). SPC is a geographic reference system in the horizontal plane describing the position of points or features with respect to other points in New Jersey.

Existing section 3.0, Map Compilation, is no longer necessary. Map compilation is a manual procedure that is no longer frequently performed. Some manual procedures, such as tablet digitizing and scanning, are discussed in proposed new subsection 3.2. Similarly, existing section 4.0, Data Automation, is almost entirely obsolete. Existing section 4.0 discusses conversion of analog data to digital data; however, the methods for conversion of data have

changed since the existing Appendix A was adopted. Proposed new subsection 3.2, Data Capture Methodology and Procedure, replaces existing sections 3.0 and 4.0, Data Automation, and discusses the new techniques in heads up digitizing (a technique that is useful for capturing or updating data from digital imagery on screen), tablet digitizing and scanning.

Proposed new section 4.0, Global Positioning System (GPS), is an updated discussion of the material that is contained in existing section 7.0. The information contained in existing 7.0 has been revised to reflect current technology, commonly used throughout the regulated community.

Proposed new section 5.0, Metadata Standards, is new, and replaces existing sections 6.0, Documentation, and 9.0, Data Dictionary. Metadata, the third cornerstone of the Department's standards, is supporting information that describes each layer of data used in creating a GIS image. It describes how the data were created, who created them, when they were created, who maintains the data, and more. The FGDC has defined the Federal metadata standard that all Federal agencies are required to follow. Because standard FGDC-compliant metadata is a critical component of information management systems and interactive mapping applications, the Department requires that all metadata it receives be FGDC-compliant.

Proposed section 6.0, Data Transfer Standards, is new. It contains a discussion of software compatibility, as well as the Department's data distribution agreement. The Department makes data available, but the users must accept the Department's data distribution agreement. The agreement contains limitations on the use of the data, as well as the language of the credit and disclaimer that must be included on any documents produced from the Department's digital data.

Proposed new section 7.0, Additional Information, contains NMAS, Digital Imagery, Basemaps, and Internet Resources subsections. Proposed subsection 7.1, National Map Accuracy Standards, incorporates the NMAS included at existing section 8.0. Proposed subsection 7.2, Digital Imagery, identifies resources from which digital aerial photographs and images are available. Some of the source and availability information is contained in existing section 2.0, Basemaps; however, the information has been updated to provide websites, where available. Proposed subsection 7.3, New Jersey Basemaps, replaces existing section 2.0, Basemaps, and includes maps that have been more recently generated than those identified in the existing Appendix A. Proposed new subsection 7.4, Internet Resources, replaces existing section 10.0, References. The Department provides in proposed new subsection 7.4 the internet addresses for many State, Federal, and private GIS resources.

The images of 1991 Photoquad Index and the 1986 Topoquad and Photoquad Index in existing Appendix A are no longer necessary. There is a more recent, 1991/92 Topoquad Index available, which makes the 1986 index obsolete. Because the indices are available electronically, via the internet, the Department no longer needs to reproduce them in the Appendix A.

Social Impact

The readoption with amendments of N.J.A.C. 7:1D will result in a positive social impact. By continuing the procedure for petitions for rulemaking, it will ensure that all citizens have a means of participating in the rulemaking process. The readopted rules will also help to ensure that all persons contracting with the Department meet a standard of responsibility for fair competition and honest performance in their dealings with the Department. Continuing the

procedure for notice of proposed rules, comments on proposed rules and public hearings will ensure that the public continues to receive notice of and is able to participate in the rulemaking process.

The mapping and digital data standards of proposed new Appendix A will continue the positive social impact of the repealed Appendix A by enhancing he Department's ability to respond to issues and to plan its environmental protection activities for the future. The use of GIS generally increases the Department's ability to identify environmentally sensitive areas and to detect and recognize environmental, demographic and other trends within the State.

Economic Impact

In most cases, the rules governing petitions for rulemaking have no economic impact upon anyone who desires to submit such a petition. A petition for rulemaking, which is usually a simple letter of request, can be prepared at nominal cost. However, an interested person who wishes to provide a more comprehensive and compelling petition may choose to see engineering, technical and legal assistance to prepare the document.

N.J.A.C. 7:1D-2 may have a negative economic impact on persons who are debarred, suspended or disqualified from contracting with the Department. The rules will not, however, have an effect upon the total number of contracts that the Department enters into. The subchapter will continue to have a positive economic impact for the Department and the public, in that it will help to ensure that the Department deals only with those contractors who maintain standards of performance and integrity.

N.J.A.C. 7:1D-5, which governs extensions of comment period, public hearings on proposed rules, notices of proposal, and the quarterly rulemaking calendar, has no economic impact.

The Department will continue to incur costs associated with publishing notice of rule proposals in newspapers in the State. It may also incur costs associated with transcribing public hearings and providing staff for those hearings. To the extent that the rule allowing an extension of the public comment period results in additional comments on individual proposals, the Department may incur costs associated with responding to those proposals. It is not possible to predict the extent of the additional costs, as they will depend on the number of proposals the Department prepares, and the number of proposals for which the Department decides to extend the comment period or to conduct a public hearing.

The cost associated with digital mapping is between $2,000 and $65,000, depending on whether the mapping is an update of existing maps, or a new project. The requirement that mapping information be submitted to the Department in a digital format is implemented only through the requirements of each particular regulatory program; thus, there is no direct economic impact from this proposal of new Appendix A. Each program within the Department may assess the needs and circumstances of its regulated community and, where appropriate, provide some specific relief from the mapping criteria. For example, a small business exemption is included in the rules governing Discharges of Petroleum and Other Hazardous Substances at N.J.A.C. 7:1E-4.10(g), and may be invoked where compliance would cost 25 percent or more of the owner or operator's gross proceeds or retained earnings. Where an exemption is granted, the program will require alternate mapping criteria that will serve the purpose.

In general, the Department believes that the use of cartographic data through the Geographic Information System (GIS) is a valuable planning tool that can be used not only by the Department, but by any person to better identify environmental and demographic trends. Additionally, the information available through GIS in graphic form can be sorted and presented more easily and inexpensively, compared to the time and work that would have been necessary were this information not available in digital form.

Environmental Impact

The rules governing petitions for rulemaking have no direct impact on the environment; however, the Department believes that the rules may have a positive indirect effect by assisting interested persons to identify rules that the Department might promulgate, amend or repeal to improve or enhance environmental protection. Similarly, the rules governing extensions of comment period, public hearings on proposed rules, notices of proposal, and the quarterly rulemaking calendar do not have a direct impact on the environment; however, they may have a positive indirect effect. They provide the public with information, which it may use to comment upon the Department's rule proposals, and call the Department's attention to issues that will improve or enhance environmental protection.

N.J.A.C. 7:1D-2 also has no direct environmental impact, but may have a positive indirect impact by assisting the Department in maintaining minimum standards of competition and performance for its contractors. As a result, the Department will be able to focus its resources on those contractors that have a history of achieving an acceptable level of performance.

The mapping and digital data standards of proposed new Appendix A will continue the positive environmental impact of the existing Appendix A by enhancing he Department's ability to respond to issues and to plan its environmental protection activities for the future. As stated above, the use of GIS generally increases the Department's ability to identify environmentally sensitive areas and to detect and recognize environmental, demographic and other trends within the State.

Federal Standards Analysis

N.J.S.A. 52:14B-4 requires State agencies that adopt, readopt or amend State regulations that exceed any Federal standards or requirements to include in the rulemaking document a comparison with Federal law. The rules proposed for readoption with amendments have not been formulated in accordance with the authority of or in order to implement, comply with or participate in any program established under Federal law. However, proposed new Appendix A brings the Department's standards into conformance with the voluntary "Geospatial Positioning Accuracy Standards" that the Federal Geographic Data Committee (FGDC) has developed and endorsed. The FGDC prepared its standards with the intent that they provide a single method that defines how to report the positional accuracy for all point geospatial data collected, produced or disseminated by the Federal government and the nation. The Department's proposed Mapping and Digital Data Standards are consistent with these Federal standards.

Jobs Impact

The Department does not anticipate that the rules proposed for readoption with amendments will have any impact on job creation or retention in the State, except that that

N.J.A.C. 7:1D-2 may have a negative impact on those businesses that are debarred, suspended or disqualified from contracting wit the Department. However, the rules have no effect on the number of contracts that the Department enters into; therefore, the number of jobs that may result from those contracts will remain constant.

Agricultural Industry Impact

The Department does not anticipate that the rules proposed for readoption with amendments will have any impact upon agriculture in New Jersey.

Regulatory Flexibility Analysis

N.J.A.C. 7:1D imposes procedural requirements upon any person choosing to petition the Department to promulgate, amend or repeal a rule. This would include "small businesses" as that term is defined in the Regulatory Flexibility Act, N.J.S.A. 52:14B-16 et seq. Since a petition for rulemaking may be made by a letter to the Department, a small business can prepare a petition that satisfies the requirements of N.J.A.C. 7:1D-2 at nominal cost. Therefore, the rule minimizes any adverse impact upon small businesses.

Under N.J.A.C. 7:1D-2, persons, including small businesses, can be suspended, debarred or disqualified from contracting with the Department for failure to comply with certain State and Federal laws, contract specifications or other requirements. This subchapter is consistent with Executive Order No. 34 (1976), which requires that all departments that engage in State contracting develop and maintain rules and regulations governing causes, conditions and procedures applicable to determinations of debarment, suspension and disqualification by that department or agency. The standards set forth in the rules proposed for readoption are necessary

for the Department to maintain minimum standards of competition and performance for its contractors. Accordingly, the Department has not established different requirements or exemptions for small businesses.

The rules proposed for readoption at N.J.A.C. 7:1D-5 do not impose any reporting, recordkeeping or compliance requirements on small businesses. Therefore, no regulatory flexibility analysis is required. The rules establish the required sufficient public interest standards for request that the Department conduct public hearings or for 30-day comment period extensions on proposed Department rulemakings, as well as the types of notice that the Department will provide for its rulemakings.

The proposal of new mapping and digital data standards in Appendix A does not have an impact on small businesses. The mapping and digital data standards in Appendix A do not establish who must submit geographical data to the Department. The standards are implemented only through the requirements of each particular regulatory program. To the extent that the requirements of the individual programs have an impact on small businesses, the rules of those individual programs provide, where appropriate, some specific relief from the mapping criteria, as discussed above in the Economic Impact.

The proposed Appendix A provides some additional relief, even if the facility may not otherwise qualify for an exemption through one of the individual programs. At subsection 2.3, Threshold Accuracy Values, the Department recommends testing by one of two methods to ensure the accuracy of the data that is provided to it. However, if the map producer is unable to test the quality of the data by either the NSSDA or NMAS test methods, it may submit its data with documentation stating that the data is not tested.

Smart Growth Impact

Executive Order No. 4 (2002) requires State agencies that adopt, amend or repeal State regulations to include in the rulemaking document a Smart Growth Impact statement that describes the impact of the proposed rule on the achievement of smart growth and implementation of the State Development and Redevelopment Plan (State Plan).

The rules proposed for readoption with amendments do not relate to the State's land use and development policies in a way that would either encourage or discourage any development or redevelopment in this State contrary to the guiding principles of the State Plan. As a result, the Department does not expect this rulemaking to have an impact on the State's achievement of smart growth or implementation of the State Plan.

The rules proposed for readoption with amendments are consistent with the goals of the State Plan, inasmuch as the proposed Appendix A, containing updated Geographic Information Systems Mapping and Digital Data Standards, enhances the Department's ability to respond to issues and to plan its environmental protection activities for the future.

Full text of the proposed readoption may be found in the New Jersey Administrative Code at N.J.A.C. 7:1D.

Full text of the proposed repeal may be found in the New Jersey Administrative Code at N.J.A.C. 7:1D, Appendix A.

Full text of the proposed new rule follows.

APPENDIX A

New Jersey Department of Environmental Protection

Geographic Information System

Mapping and Digital Data Standards

prepared by:

New Jersey Department of Environmental Protection

Office of Information Resources Management

Bureau of Geographic Information Systems

Post Office Box 428

Trenton, NJ 08625-0428

July, 2005

Overview

The New Jersey Department of Environmental Protection (NJDEP) maintains a Geographic Information System (GIS) for the storage and analysis of cartographic (mapped) and related environmental scientific and regulatory information for use by the Department. A GIS is a computer mapping system used to display and analyze geographic information and spatial databases.

Many Departmental programs require the submission of mapped data to a GIS standard. The submission of mapped data by all sectors based on this standard will facilitate data input into the Department's GIS and the integration of data with the New Jersey Environmental Management System (NJEMS). Much of these data can be shared back with the regulated community and public as appropriate. Important concepts regarding the creation, capture and delivery of digital mapped information are addressed in this document.

There are three basic concepts that must be followed.

The first concept addresses the need for all mapping to meet accepted accuracy standards. All digital data must meet or reference published standards such as those defined by the Federal

Geographic Data Committee or a defined survey standard, regardless of scale. Testing against base maps or photography of known accuracy determines the accuracy of data. This will ensure appropriate positional accuracy of the geographic data and, therefore, compatibility of digital information.

Secondly, digital data provided to or produced for the Department are required to be in North American Datum 1983 (NAD83) horizontal geodetic datum and in the New Jersey State Plane Coordinate system (SPC). SPC is a geographic reference system in the horizontal plane describing the position of points or features with respect to other points in New Jersey. All coordinates of the system are expressed in meters. The Department, however, prefers to receive and maintain data in U.S. survey feet. The official survey base of the State is known as the New Jersey State Plane Coordinate System whose geodetic positions have been adjusted on the NAD83 as per Chapter 218, Laws of New Jersey 1989.

Lastly, GIS data must also be documented using the Federal Geographic Data Committee (FGDC) Metadata Standard or be compliant with the FGDC metadata standard. Metadata is information about the digital data being provided. It is important to know not only the positional coordinates of mapped information, but also how the data was produced and the accuracy of the data being made available. The Federal Spatial Data Transfer Standard (SDTS) requires that a quality report accompany the data. This information should include a statement of the positional accuracy of the data and testing procedures used to determine positional accuracy. Geographic data must be delivered according to standard media and digital formats. Accepted formats and media currently used by the Department are presented in the body of this paper.

Programs within the Department may define additional technical mapping requirements to accommodate specific program needs.

MAPPING AND DIGITAL DATA STANDARDS

GEOGRAPHIC INFORMATION SYSTEM

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

1.0 INTRODUCTION

Geographic Information System technology has become a tool for innovative efforts to protect the natural environment and the public health of citizens, nationally and within the State of New Jersey. To adequately address these and other issues, the Department must make decisions based on sound data of known and adequate accuracy. This document provides guidance for the basic standards for creating, describing and distributing spatial data on a GIS. Basic standards will ensure consistent data quality and documentation, provide for compatibility between data sets, facilitate interactive analysis within the Department and ensure the highest quality of results derived from the GIS.

The Department endorses the Federal Geospatial Standards (FGDC, 1998) for positional accuracy as the most comprehensive and current standard. The Department continues to support National Map Accuracy Standards.

2.0 GEOSPATIAL POSITIONING ACCURACY STANDARDS AND TESTING

There are two widely accepted standards for positioning accuracy for mapped data, the Federal Geographic Data Committee (FGDC) “Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy” (1998) and National Map Accuracy Standard

(1947). The Department supports both these standards and either standard can be used for mapped data. The Department recommends the more current FGDC (1998) standard.

2.1 Federal Geographic Data Committee (FGDC)

The Federal Geographic Data Committee (FGDC) in 1998 released the endorsed version of "Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy" (NSSDA) (http://www.fgdc.gov/standards/standards.html). This standard is designed for digital spatial data. In spite of the title, it prescribes a testing methodology, rather than threshold accuracy values, and is described as a Data Usability Standard.

The NSSDA requires the following test (quoted from Sections 3.2.1, 3.2.2, and Appendix 3-A):

> The NSSDA uses root-mean-square error (RMSE) to estimate positional accuracy. RMSE is the square root of the average of the set of squared differences between dataset coordinate values and coordinate values from an independent source of higher accuracy for identical points.
>
> Accuracy is reported in ground distances at the 95% confidence level. Accuracy reported at the 95% confidence level means that 95% of the positions in the dataset will have an error with respect to true ground position that is equal to or smaller than the reported accuracy value. The reported accuracy value reflects all uncertainties, including those introduced by geodetic control coordinates, compilation, and final computation of ground coordinate values in the product.

Horizontal accuracy shall be tested by comparing the planimetric coordinates of well-defined points in the dataset with coordinates of the same points from an independent source of higher accuracy. Vertical accuracy shall be tested by comparing the elevations in the dataset with elevations of the same points as determined from an independent source of higher accuracy.

Errors in recording or processing data, such as reversing signs or inconsistencies between the dataset and independent source of higher accuracy in coordinate reference system definition, must be corrected before computing the accuracy value.

A minimum of 20 checkpoints shall be tested, distributed to reflect the geographic area of interest and the distribution of error in the dataset. When 20 points are tested, the 95% confidence level allows one point to fail the threshold given in product specifications.

Horizontal Root Mean Square Error is known as $RMSE_r$.

If error is normally distributed and independent in each the x- and y-component and error, the factor 2.4477 is used to compute horizontal accuracy at the 95% confidence level (Greenwalt and Schultz, 1968).

When the preceding conditions apply, $Accuracy_r$, the accuracy value according to NSSDA, shall be computed by the formula:

$$Accuracy_r = 2.4477 * RMSE_x = 2.4477 * RMSE_y$$

$$= 2.4477 * RMSE_r / 1.4142$$

$$Accuracy_r = 1.7308 * RMSE_r$$

Note that because this formula is based on statistical probabilities, the satisfaction of the underlying assumptions is important, and the formula also applies to a specific number of error measurements (20 points). The full FGDC document gives more information on what to do in cases where either of these requirements cannot be satisfied. It also gives direction on additional topics, and a worked example.

The NSSDA test described above has been embodied in the ArcView 3.x extension RMSEr2.avx, written by Gregory Herman of the New Jersey Geological Survey; the extension is available from the ESRI web site (http://gis.esri.com/arcscripts/scripts.cfm). Note that the extension does not provide a test of the validity of the assumptions.

A data set that has been tested for horizontal accuracy per the NSSDA standard should be reported in the metadata as *"Tested _____(meters, feet) horizontal accuracy at 95% confidence level."* Tests and reporting statements for vertical accuracy are analogous, and are shown in the FGDC document.

If alternate means of evaluating accuracy are used, the data set should be reported in the metadata as *"Compiled to meet _____(meters, feet) horizontal accuracy at 95% confidence level."*

In summary, there are seven steps in applying the NSSDA (from Positional Accuracy Handbook, 1999, Minnesota Planning Land Management Information Center):

1. Determine if the test involves horizontal accuracy, vertical accuracy, or both.
2. Select a set of test points from the data set being evaluated.
3. Select an independent data set of higher accuracy that corresponds to the data set being evaluated.
4. Collect measurements from identical points from each of those two sources.
5. Calculate a positional accuracy statistic using either the horizontal or vertical accuracy statistic worksheet.
6. Prepare an accuracy statement in a standardized report form.
7. Include that report in a comprehensive description of the data set called metadata.

The Positional Accuracy Handbook provides a very clear explanation of NSSDA and excellent examples of testing methods and non-testing assessments. It can be found at (http://www.mnplan.state.mn.us/press/accurate.html).

The NSSDA itself does not include threshold values, i.e. values of accuracy that are required for particular purposes. Sources for appropriate threshold values are discussed further below in Section 2.3.

2.2 National Map Accuracy Standard (NMAS)

The National Map Accuracy Standard, designed for paper maps, has been used since their adoption in 1941 to set accuracy requirements and to describe accuracy levels of maps. The 1947 revision is quoted in part below:

1. Horizontal accuracy for maps on publication scales larger than 1:20,000, not more than 10% of the points tested shall be in error by more than 1/30 inch, measured on the publication scale; for maps on publication scales of 1:20,000 or smaller, 1/50th of an inch. These limits of accuracy shall apply in all cases to positions of well-defined points only. Well-defined points are those that are easily visible or recoverable on the ground, such as the following: monuments or markers, such as benchmarks, property boundary monuments; intersections of roads, railroads, etc.; corners of large buildings or structures (or center points of small buildings); etc. In general what is well defined will also be determined by what is plottable on the scale of the map within 1/100 inch. Thus, while the intersection of two road or property lines meeting at right angles would come within a sensible interpretation, identification of the intersection of such lines meeting at an acute angle would obviously not be practicable within 1/100 inch. Similarly, features not identifiable upon the ground within close limits are not to be considered as test points within the limits quoted, even though their positions may be scaled closely upon the map. Examples of data in this class would be timberlines, soil boundaries, etc.

2. Vertical Accuracy, as applied to contour maps on all publication scales, shall be such that not more than 10 percent of the elevations tested shall be in error more than one-half the contour

> interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error for a map of that scale.

NMAS accuracy is described in map units (inches on the map), rather than ground units (feet or meters in the real world). Given a scale, one can translate the map units into ground units. For example, NMAS requires that a map of scale 1:12,000 shall have an accuracy of 1/30 inch; the corresponding ground unit accuracy is 33.3 ft. Although designed for paper maps, NMAS has been widely used to describe the accuracy level of digital data; for example, a digital data set is commonly described as meeting NMAS at a particular nominal scale.

As discussed above, NMAS is based on statistical testing; however the confidence level is set at 90 percent, in contrast to the 95 percent confidence level required by NSSDA. This means that the same map or data set will have a different accuracy level description (i.e. different numerical accuracy value in feet or meters) for NMAS vs. NSSDA. One can think of the horizontal accuracy as a circle of that radius around each well-defined position point: the confidence level expresses the likelihood that the actual location of the point falls within that circle. For a given “quality” of data, one needs a larger circle for a 95 percent confidence level than for a 90 percent confidence level. Appendix 3-D of the NSSDA document gives a fuller treatment of the relationship between NMAS and NSSDA.

The full text of National Map Accuracy Standards (1947) is shown in section 7.1.

2.3 Threshold Accuracy Values

The Department continues to support positioning data to meet the accuracy level of the NMAS, but using the testing methodology and reporting language of NSSDA. One approach to satisfying this requirement is to establish an appropriate nominal scale for the data/mapping in question, and use the NSSDA equivalent of NMAS values to establish threshold values for accuracy. The mathematical relationship is described in the NSSDA document (Appendix 3-D). Table 2.3.1 below shows the results of this calculation for a range of scales.

Table 2.3.1 Threshold accuracy values in ground units.

D*erived from National Map Accuracy Standards (1947).*

Scale	NMAS accuracy (feet)	NSSDA $Accuracy_r$ (feet)	NMAS accuracy (meters)	NSSDA $Accuracy_r$ (meters)
Large scale	1/30 inch (map)			
1:1,200	3.3	3.8	1.0	1.2
1:2,400	6.7	7.7	2.0	2.3
1:6,000	16.7	19	5.1	5.8
1:12,000	33.3	38	10.1	12
Small scale	1/50 inch (map)			
1:24,000	40	46	12.2	14
1:63,360	106	120	32.3	37

1:100,000	167	190	50.9	58
1:250,000	417	475	127	145
1:500,000	833	950	254	290

When the FGDC began work on the NSSDA, the subcommittee used Accuracy Standards for Large-Scale Maps (Interim, 1990) from the American Society for Photogrammetry and Remote Sensing (ASPRS) as the basis for updating NMAS. The ASPRS standards use $RMSE_x$ and $RMSE_y$ as their base statistics, and state threshold values for various scales. (Note that $RMSE_x$ and $RMSE_y$ are NOT the same as $RMSE_r$.) Discussion of these standards can be found in the NSSDA document (section 3.1.5 and Appendix 3-D). Table 2.3.2 below shows the threshold values of the ASPRS Class 1 mapping standards and their translation into $Accuracy_r$ of NSSDA (note that statistical assumptions are involved in making this calculation). As comparison of $Accuracy_r$ values between the two tables shows, the ASPRS standards are stricter than NMAS.

Should the map producer not be able to test the quality of the submitted data by either of these two tests, then the producer shall document this fact in the metadata submitted with the digital GIS data. The Department strongly recommends that when a producer of mapped information is not required to submit data to a quality standard by regulation or by contract, that an accuracy statement be submitted with the GIS data and referenced in the metadata.

Table 2.3.2 Threshold accuracy values in ground units.

Derived from American Society for Photogrammetry and Remote Sensing Class 1 Horizontal Interim Accuracy Standards for Large-Scale maps (1990).

Scale	Class 1 Planimetric Accuracy, limiting RMSE (feet)	Equivalent $Accuracy_r$, NSSDA (feet)	Class 1 Planimetric Accuracy, limiting RMSE (meters)	Equivalent $Accuracy_r$, NSSDA (meters)
1:60	0.05	0.12		
1:1,200	1.0	2.4		
1:2,000			0.50	1.2
1:2,400	2.0	4.9		
1:5,000			1.25	3.1
1:6,000	5.0	12.2		
1:10,000			2.50	6.1
1:12,000	10.0	24.5		
1:20,000	16.7	40.9	5.00	12.2

The New Jersey Society of Professional Land Surveyors (NJSPLS, http://www.njspls.org/) have also produced a set of proposed threshold $Accuracy_r$ values for several specific types of GIS data. Because these standards have not yet been adopted, they are not shown here.

3.0 NEW JERSEY DEPARTMENT ENVIROMENTAL PROTECTION GIS DATA STANDARDS

The remainder of this document describes standards adopted by the Department to facilitate data sharing and provide the basic standards for creating, describing and distributing

spatial data on its GIS. The objective is to facilitate interactive analysis of data of the highest quality within the Department.

3.1 Datum and Projection

3.1.1 Horizontal Datum and Vertical Datum

The North American Datum of 1983 (NAD83) is required for mapping in the horizontal plane. The North American Vertical Datum of 1988 (NAVD 88) should be used when possible rather than the older National Geodetic Vertical Datum of 1929 (NGVD29).

3.1.2 Projection and Coordinate System

Based on the Chapter 218, Laws of New Jersey 1989, New Jersey State Plane is required in meters (the Department prefers feet), NAD83. The State of New Jersey is entirely contained within one state plane zone (2900). Special situations may require other projection systems for small-scale maps of regional (interstate) or national interest. The Department's GIS prefers to use feet as the units of measure and serves all of its data in the following Projected Coordinate System: NAD_1983_StatePlane_New_Jersey_FIPS_2900_Feet

3.2 Data Capture Methodology and Procedure

GIS information comes from a variety of sources, which can produce a wide range of positional accuracy. Consequently, each source must be evaluated to determine whether redrafting is necessary to prepare the data for entry into the GIS. Heads-up digitizing, Tablet digitizing, Scanning, and Global Positioning Systems (See Section 4.0) are all viable methods to input data to a GIS. Much of the data required for a GIS can be derived directly from the photo-

interpretation of aerial photos or from rectified photo basemaps**.** Whichever method is used it is important that the most accurate data source set be used whenever possible. For New Jersey the February-April, 2002 digital color infrared (CIR) orthophotography 1:2400 (1"=200') are currently the preferred reference for heads up digitizing. Only differentially corrected GPS coordinates may surpass this source in accuracy.

3.2.1 Heads-Up Digitizing

Heads-Up digitizing is a technique that is useful for capturing or updating data from digital imagery on screen. High-resolution digital imagery now allows GIS users to edit and delineate features directly on the screen using desktop GIS software. The following considerations should be carefully planned out in advance.

1. The user must document procedures when using this technique.
2. Scale used for data capture should be established & documented. Recommended scales for digitizing should be between 1:1200 to 1:4000 over DOQQ. Below 1:1200 the imagery becomes extremely blurred. Above 1:4000 accuracy could be compromised.
3. Digitizing tolerances should be established and documented.
4. Users should maintain clear definitions or classifications of features that are being interpreted and delineated.
5. Ground truth (field verification) remains an important step in establishing the quality of heads-up digitizing, particularly for land cover delineation.
6. Make sure appropriate entries concerning the quality of the data are documented in the metadata files.

Detailed classification systems and resolution of imagery may require that features be captured on the screen and then photo-interpreted from aerial photography to the digital image. Photo-interpreting and heads-up digitizing at the same time can be extremely difficult even for experienced users.

All attribute coding shall be 100 percent correctly coded. A full description of each code should be provided as part of the metadata. The coding of features should follow an approved classification system as adopted by State and Federal agencies. These codes follow specifications of organizations responsible for deriving and maintaining the data. For example, the Department uses the Cowardin et al. (1979) system for the Classification of Wetland and Subaqueous Lands in the United States as adopted by the National Wetlands Inventory of the U.S. Fish and Wildlife Service. In addition the Department supports a modified version of Anderson et al. (1976), USGS, for classifying land use/land cover. For prototype classification schemes, clear concise documentation describing the classes is required.

3.2.2 Tablet Digitizing

Tablet digitizing is a common method of getting data into a GIS. The procedure involves tracing lines or locating points with a computer mouse on a digitizer. The manuscript's lines should be clear and complete with no gaps or shortfalls. Operators should not interpret and digitize at the same time. The digitizer should concentrate solely on capturing the exact nature of the features. All maps shall be edge matched prior to digitization to eliminate cartographic errors and reduce digital problems. Digital accuracy shall be evaluated by proof plotting the digital data to the base at the same scale as the manuscript and overlaying the data to the original map. The

line work should be digitized in such a way as to create a digital copy that is within +/- one line width of the original. Edits can be flagged and corrected such that the standard is met. Coverage TICS should be identified and RMS errors documented in the metadata.

3.2.3 Scanning and Recompilation

Scanning of features from hardcopy sources or the recompilation of existing digital data, involves the redrafting of features from one source to a more accurate, planimetric source based on identifiable features. This method is commonly used to improve the quality of data that has been delineated on sources of unknown or unspecified quality or paper manuscripts. It is also commonly used to transfer data or non-rectified photography to a rectified orthophoto basemap based on a series of local fits of common photo-identifiable features, such as roads.

Other data sources without photo-images may be recompiled to planimetric sources by using other coincident features. For instance, grids on source data may be generated and plotted to planimetric basemaps and used as a guide for the redrafting of information that would otherwise not be usable in a digital form. This has been used to draft historical purveyor boundaries from old atlas sheets to the photoquads, for instance. Whatever the technique, metadata must be completed describing the recompilation techniques employed.

4.0 GLOBAL POSITIONING SYSTEM (GPS)

The NAVSTAR Global Positioning System (GPS) has become a mainstream technology for data collection for GIS. In New Jersey, state, county and municipal government agencies, academic institutions, public utilities, non-profit organizations, and private firms are using the technology to collect positions of features associated with their activities. A GPS receiver is able

to determine its 3D position (latitude, longitude, and elevation) on the surface of the earth, store location information and convert the coordinates into features for use in a GIS. Users can not only capture a feature's location, but also enter descriptive attribute data that significantly adds to the final data layer's value in GIS.

GPS is most effective when the GPS receiver's antenna has an unobstructed view of the sky. Buildings in urban areas and dense tree cover can create reception problems making GPS collection work difficult in these types of environments. The GPS receiver must be able to receive relatively clear signals from at least four satellites simultaneously to determine a 3D position or fix. Depending on the design of the GPS receiver, and the data collection/data processing techniques used, the horizontal range of accuracy can be 15 meters to sub-centimeter.

Positional data collected with GPS must, at a minimum, meet within a 5 meter, 95 percent confidence standard. This requires all GPS data to be differentially corrected. If accuracy requirements call for higher accuracy, parameter settings have to be adjusted accordingly in order to meet the higher standard.

The Department has adopted standards for the critical settings for rover (field data) receivers that are consistent regardless of which receiver model is being used. Users should not deviate from these standards. These settings include:

Table 4.0.1 Critical and Recommended Settings for Data Collection

Standard GPS Collection Parameter Settings

Position Mode	Manual 3D is the normal setting.

Elevation Mask	15 degrees above horizon.
PDOP Mask	6
Signal to Noise Ratio Mask (SNR)	6
Minimum Positions for Point Features	200 (100 for Trimble Pro XL, 60 for Pro XR)
Logging Intervals	Intervals for point features will be 1 second or faster. Intervals for line and area features depend on the velocity at which the receiver will be traveling and the nature of the feature and the operating environment. Under normal circumstances (i.e., when the user is walking with the receiver) the interval for line and area features will be set to a 5-second interval.
Logging of DOP	Turned On.

For detailed information on recommended GPS receiver settings and collection procedures, see the Department's *Standards for Using Code-Based Global Positioning Systems (GPS) for the Development of Accurate Location Data for Use with Arc/Info and ArcView Geographic Information Systems*. (http://www.state.nj.us/dep/gis/gpsoutstand.html)

5.0 METADATA STANDARDS

Metadata is required for all digital data layers created by the Department. Metadata is supporting information that describes the digital data layer and is critical for users to understand

the key components of the data. Metadata describes how the data were created, who created and maintains the data, when the data were created and/or updated, item (attribute) descriptions, transfer standards, and more. The Federal Geographic Data Committee has defined the Federal metadata standard that all Federal agencies are required to follow for each digital data layer. The Department requires that metadata be provided with each digital data layer and that the metadata be FGDC compliant. Standard FGDC compliant metadata is a critical component of information management systems (clearinghouses) on the World Wide Web (WWW) and for any interactive mapping applications provided across the WWW.

The following is a statement from the FGDC on the metadata standard:

> The objectives of the standard are to provide a common set of terminology and definitions for the documentation of digital geospatial data. The standard establishes the names of data elements and compound elements (groups of data elements) to be used for these purposes, the definitions of these compound elements and data elements, and information about the values that are to be provided for the data elements.
>
> This standard is the data documentation standard referenced in the executive order (Executive Order 12906, "Coordinating Geographic Data Acquisition and Access: the National Spatial Data Infrastructure)." The standard was developed from the perspective of defining the information required by a prospective user to determine the availability of a set of geospatial data, to determine the fitness the set of geospatial data for an intended use, to determine the means of accessing the set of geospatial data, and to successfully transfer the set of geospatial data. As such, the standard establishes the names of data

elements and compounds elements to be used for these purposes, the definitions of these data elements and compound elements, and information about values that are to be provided for the data elements.

For more information on metadata, go to the Department's GIS Metadata page (http://www.state.nj.us/dep/gis/metastan.htm). For examples of metadata for GIS data layers go to the New Jersey Geographic Information Network (NJGIN) and "Search" for data (https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp).

Additional information can be found at (http://www.fgdc.gov/metadata/metadata.html).

For examples of metadata please go to the New Jersey Geographic Information Network and search for GIS data (https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp). For additional resources go to the Department's GIS web site (http://www.state.nj.us/dep/gis/metastan.htm) for a description of metadata and additional examples.

6.0 DATA TRANSFER STANDARDS

In order to enhance data exchange, the following standards should be followed. Presented below are recommended exchange standards for ESRI's Arc suite of products.

6.1 Software

Digital Exchange Standards for GIS

Table 6.1.1 details the exchange standards recommended for the exchange with the Department's GIS software. For "relate," "join" or "link" databases, dbase IV, Access and Excel are preferred over INFO look up tables.

Table 6.1.1 NJDEP GIS Compatible Configurations

PLATFORM	*UNIX Workstation*	*PC*
OPERATING SYSTEM	UNIX	Windows 2000, XP

SOFTWARE/ File Format	ArcGIS 9.x Workstation Geodatabase Coverage Shape Files ArcView 3.x Coverage Shape Files DXF	ArcGIS 9.x Geodatabase Personal Geodatabase Coverage Shape Files ArcView 3.x shape files DWG (AutoCad) DGN (Microstation) DXF
DATA TRANSFER	Arc/Info Interchange File (*.e00) Shapefile XML	Arc/Info Interchange File (*.e00) Shapefile XML Winzip (rename to *.abc) (* = name of file)

MEDIA	CD-ROM (CD-R) DVD 3 1/2" HD 1.44MB	CD-ROM (CD-R) DVD 3 1/2" HD 1.44MB Zip Disk (100 or 250MB)

6.2 Data Distribution

6.2.1 Digital Transfer Methods

Data are available in the following a variety of formats from a variety of sources today. The formats, usually available in compressed Zip file format, should be compatible with Table 6.1. The New Jersey Geographic Information Network (NJGIN) (https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp) is the preferred centralized location and method for data distribution to users outside the Department.

6.2.2 Data Supplied by NJDEP

For data supplied by the Department the following Distribution Agreement (NJDEP) shall accompany all data transfers. The users agrees to abide by the terms and conditions of the following:

I. Description of Data to be provided

The data provided herein are distributed subject to the following conditions and restrictions.

For all data contained herein, (NJDEP) makes no representations of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied with respect to the digital data layers furnished hereunder. NJDEP assumes no responsibility to maintain them in any manner or form.

II. Terms of Agreement

1. Digital data received from the NJDEP are to be used solely for internal purposes in the conduct of daily affairs.

2. The data are provided, as is, without warranty of any kind and the user is responsible for understanding the accuracy limitations of all digital data layers provided herein, as documented in the accompanying Metadata, Data Dictionary and Readme files. Any reproduction or manipulation of the above data must ensure that the coordinate reference system remains intact.

3. Digital data received from the NJDEP may not be reproduced or redistributed for use by anyone without first obtaining written permission from the NJDEP. This clause is not intended to restrict the distribution of printed mapped information produced from the digital data.

4. Any maps, publications, reports, or other documents produced as a result of this project that utilize the Department's digital data will credit the Department's Geographic Information System (GIS) as the source of the data with the following credit/disclaimer: "This (map/publication/report) was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized."

5. Users shall require any independent contractor, hired to undertake work that will utilize digital data obtained from the Department, to agree not to use, reproduce, or redistribute NJDEP GIS data for any purpose other than the specified contractual work. All copies of the Department's GIS data utilized by an independent contractor will be required to be returned to the original user at the close of such contractual work.

Users hereby agree to abide by the use and reproduction conditions specified above and agree to hold any independent contractor to the same terms. By using data provided herein, the user acknowledges that terms and conditions have been read and that the user is bound by these criteria.

7.0 ADDITIONAL INFORMATION

7.1 National Map Accuracy Standard (NMAS)

NATIONAL MAP ACCURACY STANDARDS

United States National Map Accuracy Standards

U.S. Bureau of the Budget, Revised June 17, 1947

With a view to the utmost economy and expedition in producing maps, which fulfill not only the broad needs for standard or principal maps, but also the reasonable particular needs of individual agencies, standards of accuracy for published maps are defined as follows.

1. Horizontal accuracy, for maps on publication scales larger than 1:20,000, not more than 10% of the points tested shall be in error by more than 1/30 inch, measured on the publication scale; for maps on publication scales of 1:20,000 or smaller, 1/50th of an inch. These limits of accuracy shall apply in all cases to positions of well-defined points only. Well-defined points are those that are easily visible or recoverable on the ground, such as the following: monuments or markers, such as benchmarks, property boundary monuments; intersections of roads, railroads, etc.; corners of large buildings or structures (or center points of small buildings); etc. In general what is well defined will also be determined by what is plotable on the scale of the map within 1/100 inch. Thus, while the intersection of two road or property lines meeting at right angles would come within a sensible interpretation, identification of the intersection of such lines meeting at an acute angle would obviously not be practicable within 1/100 inch. Similarly, features not identifiable upon the ground within close limits are not to be considered as test points within the limits quoted, even though their positions may be

scaled closely upon the map. In this class would come timberlines, soil boundaries, etc.

2. Vertical Accuracy, as applied to contour maps on all publication scales, shall be such that not more than 10 percent of the elevations tested shall be in error more than one-half the contour interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error for a map of that scale.

3. The accuracy of any map may be tested by comparing the positions of points whose locations or elevations are shown upon it with corresponding positions as determined by surveys of a higher accuracy. Tests shall be made by the producing agency, which shall also determine which of its maps are to be tested, and the extent of such testing.

4. Published maps meeting these accuracy requirements shall note this fact on their legends, as follows: "This map complies with National Map Accuracy Standards."

5. Published maps whose errors exceed that aforestated shall omit from their legends all mention of standard accuracy.

6. When a published map is a considerable enlargement of a map drawing (manuscript) or of a published map, that fact shall be stated in the legend. For example, "This map is

an enlargement of a 1:20000-scale map drawing," or "This map is an enlargement of a 1:24000-scale published map."

7. To facilitate ready interchange and use of basic information for map construction among all Federal mapmaking agencies, feasible and consistent with the uses to which the map is to be put, shall conform to latitude and longitude boundaries, being 15 minutes of latitude and longitude, or 7.5 minutes, or 3-3/4 minutes in size. (From Thompson, 1987).

7.2 Digital Imagery (Meets NMAS)

2002 Digital color infrared (CIR) orthophotography

Aerial photography of the entire State of New Jersey was captured during February-April, 2002. Digital color infrared (CIR) orthophotography was produced at a scale of 1:2400 (1"=200') with a 1 foot pixel resolution for New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet. Digital orthophotography combines the image characteristics of a photograph with the geometric qualities of a map. Digital orthophotography is a process, which converts aerial photography from an original photonegative to a digital product that has been positionally corrected for camera lens distortion, vertical displacement and variations in aircraft altitude and orientation. The ortho-rectification process achieved a +/- 4.0 ft. horizontal accuracy at a 95% confidence level, National Standard for Spatial Data Accuracy (NSSDA).

This dataset consists of 5000' x 5000' files in MrSID format with a 15:1 compression ratio. The files, which can be selected and downloaded from the NJGIN site, were produced utilizing MrSID Geospatial Edition 1.4 and are approximately 5 MB in size.

State Resource: NJ Geographic Information Network (NJGIN) (https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp)

The 2002 orthos are available for purchase in MrSID compressed format (on DVD media only) from the USGS-EROS Data Center.

A complete set of orthos for the State is available on 13 DVDs at a cost of $785.00. Note: If you are NOT purchasing a complete set of orthos on 13 DVDs, you need to include the DVD series number (i.e., DVD 1 of 13, DVD 2 of 13, etc.) with your order.

The MrSID Index with the series number for each DVD is provided as an ESRI shapefile from the NJGIN site.

Pricing Information: $60 per DVD + $5 handling fee per order (subject to change).

Payment, or obligation by way of a purchase order, must be received by the USGS-EROS Data Center before order processing may begin. All instruments of payment are to be made payable to Department of the Interior, USGS. The link for payment options is:

http://edc.usgs.gov/about/customer/modes.html

To order: Send email to custserv@usgs.gov or contact Kim Brown at 1-800-252-4547, ext. 2061. USGS-EROS Data Center Business Hours: Monday through Friday, 8:00 a.m. to 4:00 p.m., Central Time.

1995-97 Digital color infrared (CIR) orthophotography

The imagery conforms to the standards of USGS "standard product" for digital orthophoto quarterquads (DOQQs). Many organizations including the Department use these high quality images as digital base maps for mapping applications.

The 1995/97 imagery is color infrared (CIR), has 3 bands, 1 meter resolution, and is NAD83 in UTM (meters). The standard product is available through the USGS EROS Data Center. The Department has made the data available on the GIS server in SPC feet, NAD83. The imagery is available from the following resources:

Federal Resource:	http://edcwww.cr.usgs.gov/webglis
	http://mapping.usgs.gov/
	USGS (703) 648-5931
State Resource:	NJ Geographic Information Network
	(https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp)

1991-92 Digital imagery

The 1991-92 digital imagery is available at 5-ft (quarter quad) resolution or 10 ft (quad) grayscale (1 band) digital files, NAD83. These images meet NMAS at the production scale (1:12000) and are the manuscript images from which the 1991-92 Mylar basemaps were made. The files are *.gis* (ERDAS) files and are 16mb each. These digital images are available only from MARKHURD.

Contractor Resource: MARKHURD, Minneapolis, MN (1-800-MAP-HURD).

7.3 New Jersey Basemaps (Meets NMAS)

The Department has created several source basemaps that are available for mapping initiatives that meet or exceed NMAS. Basemaps provide the foundation for many mapping projects and for the display of mapped information. As such, basemaps must meet uniform, rigorous standards for positional accuracy and cartographic integrity. Over the years, several series of quality basemaps that meet or exceed NMAS have been produced. Basemaps can be either hardcopy (Mylar or acetate) or digital (softcopy). A statewide synoptic set of hardcopy basemaps for New Jersey was made from aerial over-flights sponsored by the Department in 1991 and 1986. In both cases, both quadrangle (1:24000) and quarter quadrangle (1:12000) hardcopy Mylar basemaps were produced. Other basemaps cover specific areas only, such as the 1977-78 Tidelands photo basemaps. Two series of digital (softcopy) basemaps have also been produced, from the 1991 and 1995/97 over-flights. The digital images were produced at quarterquad scale (1:12000).

* Hardcopy (Mylar) Basemaps

Listed below in order of general overall quality is available New Jersey basemap series that were produced on stable base mylar and meet a definable mapping standard (NMAS). The first four series listed are photo basemaps, derived from aerial photography. The 1991/92 and the 1986 wetland series are both orthophoto basemaps compiled from a sophisticated aero-

triangulation process. They should be used whenever possible to generate GIS compatible data and/or to use as a recompilation base.

All the hardcopy basemaps described herein with the exception of the 1991/92 products are referenced in NAD27. For this reason, the 1991/92 mylar basemap quads (1:24000) and quarterquads (1:12000) series, referenced in NAD83 are highly recommended by the Department over all other sources listed for mapping at these scales. Stable base site maps of large scale meeting NMAS, produced by surveying, mapping or photogrammetric firms may qualify as GIS compatible if they contain a minimum of four registration tics in the New Jersey State Plane Coordinate System, North American Datum 1983 (NAD83), the official survey base of New Jersey. The USGS topoquad series are not recommended as a delineation source because they are generally available only on paper and are not synoptic data sources. Rather, they represent variable data sources and dates.

* **1991/92 Orthophoto Basemaps (Quadrangles and Quarter quadrangles)**

The most recent statewide set of hardcopy chronoflex quarterquad (1:12000) and photoquad (1:24000) photo basemaps were produced from the 1991/92 aerial overflight of the State. These basemaps meet or exceed NMAS. This series of maps is referenced in SPC feet in NAD83, but also has NAD27 tics in the margin. This series is the most current, highest quality basemaps of their scale available statewide, that are referenced in the new datum, NAD83. This basemap series is highly recommended by the Department for mapping efforts at these scales.

* **1986 Freshwater Wetlands Orthophoto Quarterquad Basemaps (1:12000)**

The passage of the Freshwater Wetlands Act of 1987 required the State to produce a composite map of the freshwater wetlands (FWW) for the State. Subsequently, a set of 635 chronoflex photo quarterquads for the entire State from the March 1986 overflight was produced. The maps represent an excellent source for both photo-interpretation and recompilation at a county, municipal or site level. However, these maps are dated and are referenced in the old datum (NAD27). The 1991/92 series now supercedes these maps. There is also a set of composite hardcopy FWW maps with the delineation superimposed on the image.

* **1986 Photoquad Basemaps (1:24000)**

A statewide overflight in March 1986 produced a complete set of stable base photoquads at 1:24000. The control for the production of these basemaps was the Mylar USGS 7.5-Minute topoquads. The photoquads have been widely used both to create data layers and to recompile other data sources from paper or non-planimetric sources. These basemaps did not follow rigorous orthophoto techniques and are referenced in the old datum. The 1991/92 basemaps supercedes these maps.

* **1977/78 Tidelands Basemaps (1:2400)**

The tidelands maps are a series of 1:2400 base maps for the coastal zone that include all tidal areas in the State to delineate the State's claim to all tide-flowed lands. The series consists of 1628 photo basemaps. These maps are rectified products that meet NMAS below the ten-foot contour. The photo-image is late summer of 1977 and 1978. These maps cover the entire coastal zone up to the head-of-tide.

* USGS 7.5-Minute Series Topoquad Basemaps (1:24000)

The USGS has published an entire series of 172 topographic maps for the State at a scale of 1:24000. The base information ranged from the late 1940s to the 1980s with photo-updates into the mid 1990s. Because these maps vary in source date, and because more accurate and current basemaps (1991/92) are available, the USGS topoquads series *is not recommended* by the Department as a mapping base. The topoquads do represent an excellent reference source, particularly for named places and features.

Basemap Resources

Mylar photo basemaps from 1991, 1986 and 1977/78 and the digital imagery from 1991 may be obtained from MARKHURD, Minneapolis, MN (1-800-MAP-HURD). There are several sets of the 1986 and 1991 chronoflex (Mylar) base maps in the Department. The GIS Unit has a set of each for reference.

Paper prints of 1986 and 1991 orthophoto basemap series, as well as paper prints of USGS topoquads, may be obtained from the Department's Maps and Publications; (609) 777-1038. Paper prints from the 1977/78 series are available from the Bureau of Tidelands Management: (609) 292-2573.

Topoquads and other USGS Federal maps (and aerial photos) may be ordered from 1-800-USA-MAPS or (703) 648-5931.

Aerial Photograph Resources

Historic aerial photography is available for inspection at the Department's Tidelands Management Program (TMP) by scheduled appointment. The 1986, 1991/92, 1995/97 and 2002

photo color infrared frames are also available for inspection at the TMP. Appointments are required. The 1991/92 and 1995/97 photos may also be purchased from the USGS EROS Data Center.

Federal Resource: http://mapping.usgs.gov/

USGS (703) 648-5931

Department Resource: Tidelands Management Program (609) 633-7369

7.4 Internet Resources

NJDEP, BGIS: http://www.state.nj.us/dep/gis

NJ Geographic Information Network: https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp

GPS Resource: http://www.state.nj.us/dep/gis/newgps.htm

FGDC Resources: http://fgdc.er.usgs.gov/standards

http://geochange.er.usgs.gov/

http://www.fgdc.gov/

http://www.fgdc.gov/standards/standards.html

http://www.fgdc.gov/standards/documents/proposals/swathpr3.html

USGS Resource: http://edcwww.cr.usgs.gov/

(EROS) Data Center

ASPRS Resource: http://www.asprs.org/asprs/resources/standards.html

NOAA Resource: http://www.csc.noaa.gov/crs/ccap_index.html

Coastal Change Analysis Program (C-CAP):

"Guidance for Regional Implementation"

Private Resource: http://www.spaceimaging.com/

Contains Landsat TM ortho-corrected processing procedures.

Surveyor Resource: http://www.njspls.org/

(NJ Society of Professional Land Surveyors)